(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 213 276 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
12.06.2002 Bulletin 2002/24

(21) Application number: **00126655.0**

(22) Date of filing: **05.12.2000**

(51) Int Cl.[7]: **C07C 35/18**, C07C 43/188, C07C 49/647, C07C 49/683, C11B 9/00

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(71) Applicant: **Givaudan SA**
1214 Vernier-Genève (CH)

(72) Inventor: **Goeke, Andreas**
8600 Dübendorf (CH)

(74) Representative: **Patentanwälte**
Schaad, Balass, Menzl & Partner AG
Dufourstrasse 101
Postfach
8034 Zürich (CH)

(54) Substituted cyclohexenes

(57) The present invention relates to substituted cyclohexenes, to their use as well as to their preparation method. These compounds have powerful long lasting natural fruity grapefruit notes with minty and fresh green tonalities.

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Description

[0001] The present invention relates to substituted cyclohexenes, to their use as well as to their method of preparation.

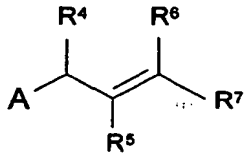
[0002] The main disadvantage of organoleptic compounds of natural origin, such as grapefruit oil, is, apart from price and availability, their changing quality and odor as well as flavor characteristics. The compounds of grapefruit oil, which are responsible for the typical odor and flavor are well known: Nootkatone was object of many syntheses and structurally related bicyclic compounds were described in various patents. Nonetheless, nootkatone is still too expensive for many applications and its analogues often lack various facets of the natural product. Sulfur containing compounds like 1-p-menthene-8-thiol have also been used in grapefruit accords. Other compounds in this domain are 4-methoxy-2-methylbutan-2-thiol and 8-mercapto-p-menthone. However, these compounds are chemically and olfactorely non homogenous mixtures and, in addition, are sensitive towards oxidation. A further compound exhibiting a fruity, cassis like odor is described in EP 0 167 709.

[0003] It is an object of the present invention to provide compounds having long lasting and natural grapefruit notes accompanied by floral and fresh green aspects.

[0004] Further it is an object of the present invention to provide compounds with above organoleptic characteristics which do not contain sulfur.

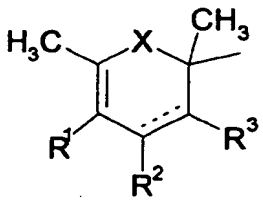
[0005] Further it is an object of the present invention to provide an inexpensive method for preparing such compounds.

[0006] It has surprisingly been found that compounds of the general formula (I)

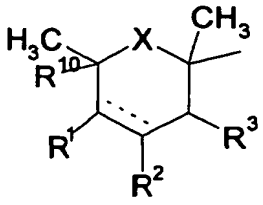


(I)

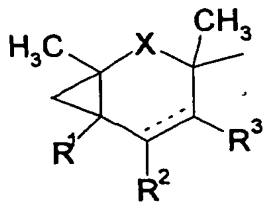
have powerful long lasting natural fruity grapefruit notes with minty and fresh green tonalities. In compounds of the formula I having less than 18 carbon atoms, A stands for a residue of the formula II, III or IV



(II)



(III)

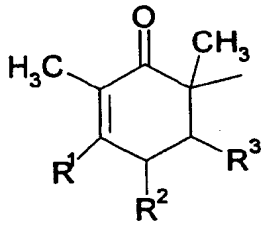


(IV)

wherein
R^1-R^6 are independently hydrogen or a methyl group, R^7 is a methyl or ethyl group, and R^5 and R^7 may form together a phenyl ring or a furan;
X is either a carbonyl group or CR^8OR^9, wherein R^8 is hydrogen, methyl, ethyl, propyl, ethinyl or vinyl and R^9 is hydrogen, methyl or ethyl;
R^{10} is hydrogen, methyl or ethyl;
the dotted line in formula (II) can only be an optional double bond if X is CR^8OR^9; and
the dotted lines in formula (III) and formula (IV) are optional double bonds.

[0007] The above formula include all possible stereo- and double bond isomers.

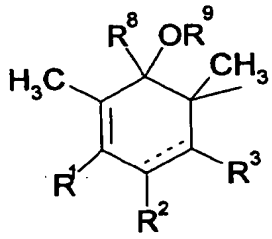
[0008] Compounds of formula I wherein A is a residue of formula IIa



(IIa)

wherein R^1-R^3 are independently hydrogen or a methyl group are preferred.

[0009] Further preferred are compounds of formula I wherein A is a residue of formula IIb



(IIb)

wherein
R^1-R^3 are independently hydrogen or a methyl group;
R^8 is hydrogen, methyl, ethyl, propyl, ethinyl or vinyl and R^9 is hydrogen, methyl or ethyl;
and the dotted line in formula (IIb) is an optional double bond.

[0010] Especially preferred compounds are:

1,2,6-trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol,
2,6-dimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol,
2,6-dimethyl-6-(3-methyl-but-2-enyl)-1-vinyl-cyclohex-2-enol,
2,6-dimethyl-1-ethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol,
2,6-dimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enone,
6-benzyl-2,6-dimethyl-cyclohex-2-enone,
6-methoxy-1,5,6-trimethyl-5-(3-methyl-but-2-enyl)-cyclohexene,

2,2,6-trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-3-enone.

[0011] In an organoleptic composition compounds according to the present invention may be used alone or in combination with numerous fragrance or flavor ingredients of natural and/or synthetic origin. The range of the natural fragrances or flavors includes in addition to readily volatile, also moderately and only slightly volatile components. The synthetic fragrances or flavors embrace representatives from practically all classes of fragrance or flavor substances. The following list comprises examples of known fragrances or flavors which may be combined with the compounds of the invention:

natural products: tree moss absolute, basil oil, tropical fruit oils (such as bergamot oil, mandarin oil, etc.), mastix absolute, myrtle oil, palmarosa oil, patchouli oil, petitgrain oil, wormwood oil, lavender oil, rose oil, jasmin oil, ylang-ylang oil, etc.;

alcohols: farnesol, geraniol, linalool, nerol, phenylethyl alcohol, rhodinol, cinnamic alcohol, (Z)-hex-3-en-1-ol, menthol, α-terpineol, etc.;

aldehydes: citral, α-hexyl cinnamaldehyde, Lilial, methylionone, verbenone, nootkatone, geranylacetone, etc.;

esters: allyl phenoxyacetate, benzyl salicylate, cinnamyl propionate, citronellyl acetate, decyl acetate, dimethylbenzylcarbinyl acetate, dimethylbenzylcarbinyl butyrate, ethyl acetoacetate, cis-3-hexenyl isobutyrate, cis-3-hexenyl salicylate, linalyl acetate, methyl dihydrojasmonate, styralyl propionate, vetiveryl acetate, benzyl acetate, geranyl acetate, etc.;

lactones: γ-undecalactone, δ-decalactone, pentadecanolide, 12-oxahexadecanolide, etc.;

acetals: Viridine (phenylacetaldehyde dimethylacetal), etc.;

other components often used in perfumery: indole, p-mentha-8-thiol-3-one, methyleugenol, eugenol, anethol, etc..

[0012] The compounds of the present invention harmonize particularly well with floral notes (lily of the valley, rose, iris, jasmine, ylang-ylang, narcissus notes, etc.) as well as with woody, chypre and animalic notes, tobacco- and an patchouli-like compositions, etc.

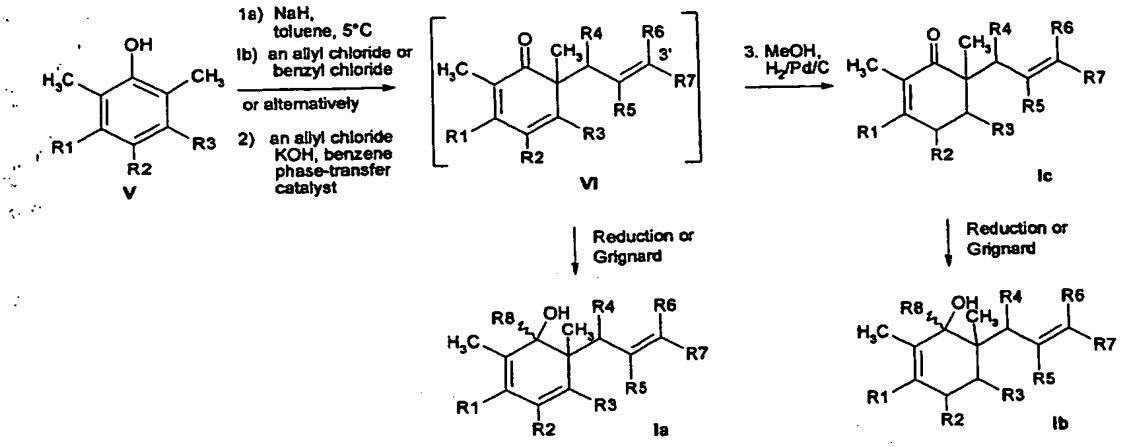
[0013] The percentage in which the compounds of the invention are used in a composition may vary within wide limits ranging from a few parts per thousand in mass market products (e.g. cleaning compositions, deodorant, etc.) up to a few percents in alcoholic extracts for fine perfumery. In all cases, the compounds of formula I provide fragrance compositions with powerful long lasting natural fruity grapefruit notes and minty and fresh green tonalities. Flavoured products comprise compounds according to the present invention at a concentration of 0.1 to 10 ppm.

[0014] Compositions comprising one or more compounds according to the present invention are preferably used in consumer products and industrial products. A few examples are body care and cosmetic products such as cream, shampoo, soap, sun cream, household products such as detergent, household cleaner, fabric softener, etc..

[0015] In a preferred embodiment food and beverage products comprise one or more compounds according to the present invention.

[0016] Compounds according to the present invention can be prepared as depicted in scheme 1 and 2.

Scheme 1:



[0017] C-Alkylations of 2,6-disubstituted phenols by reaction of a phenol with a metal hydride and an alkenylchloride are known in the art (Greuter, H. et al. (1977) *Helv. Chim. Acta,* 60, 1701). The resulting dienones are known to be unstable and to rearrange to higher alkylated phenols, or to aryl-alkenyl-ethers, or the allyl unit may also be cleaved off under certain reaction conditions known to those skilled in the art (Chalais, S. et al. (1986) *Tetrahedron Lett.,* 27, 2627).

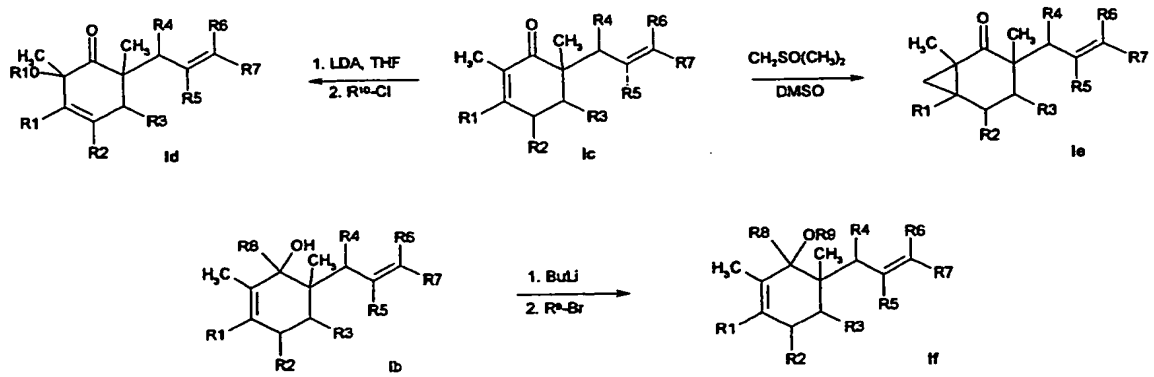
[0018] The alkylation for preparing the compounds of the present invention can also be performed under phase-transfer conditions, which avoids the use of the expensive metal hydride. It was surprisingly found, that the intermediate dienones of the formula VI of scheme 1 can be selectively hydrogenated with a transition metal catalyst, instead of generating the above mentioned side products. A preferred transition metal catalyst is palladium on charcoal. This hydrogenation is especially efficient for substrates of scheme 1 wherein the 3'-position (R^6 and R^7) is dialkylated, or for substrates of scheme 1 wherein R^5 and R^7 constitute an aromatic ring.

[0019] The α,β-unsaturated ketones of the formula Ic may be converted to cyclohexenol derivatives of the formula Ib. Depending on number and location of substituents on the cyclohexene ring, 2 or more diastereomeric alcohols may be formed. For example, 1,2,6-trimethyl-6-(3-methyl-but-2-enyl)-cyclohexenol consists of 2 isomers, one having a borneol/grapefruit character with a GC threshold of 18 ng/L, the other having a grapefruit/cassis note with an odor threshold of 0.5 ng/L.

[0020] The unsaturated ketones of the formula VI may be converted to cyclohexadienol derivatives of the formula Ia according to the process illustrated in scheme 1.

[0021] In addition, compounds of the formula Ic and of the formula Ib (scheme 1) may further be converted as described in scheme 2.

Scheme 2:



[0022] The invention will be further described, by way of illustration, in the following examples.

[0023] All compounds were unambiguously identified by their ^{1}H-NMR- (chemical shifts (δ) are given in ppm downfield from TMS; coupling constants *J* in Hz), IR- and MS-spectra.

Example 1

Synthesis of 2,6-dimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enone

[0024] Odor: fruity, grapefruit, minty, bergamot

[0025] Sodium hydride (60%, 85 g, 2.13 mol) was added portionwise to a solution of 2,6-dimethylphenol (250g, 2.05 mol) in 2L of toluene at 10-15°C. The resulting suspension was stirred for 45 min. The mixture was cooled to 5°C, and prenyl chloride (262g, 2.13 mol, 85%) was added during 1.5 h keeping the temperature at 5°C. The mixture was then stirred for further 2h at 10-15°C. Methanol (1L) and palladium (2.5g, 10% on charcoal) was added and the grey suspension was hydrogenated at 0.3 bar overpressure, keeping the temperature at 20-22°C (ice bath). The suspension was then filtered through a pad of celite. The yellow filtrate was washed with water (0.5L), aqueous sodium hydroxide (0.5L) and brine (0.5L), dried ($MgSO_4$) and concentrated *in vacuo*. The residue was distilled over a 5cm Vigreux column to yield 318g (81%, bp 78-82°C/0.05Torr) of a colorless oil. ^{1}H-NMR (400MHz, $CDCl_3$): 6.62 (bs, 1H, 3-H), 5.06-5.11 (m, 1H, 2'-H), 2.34-2.28 (m, 2H, 4-H), 2.25-2.14 (m, 2H, 1'H), 1.91 (dt, $J_{5a,5b}$ = 13.6 Hz, $J_{5a,4}$ = 6.1 Hz, 1H, 5_a-H), 1.76 (s, 3H, 2-CH_3), 1.77-1.70 (m, 1H, 5_b-H), 1.70 (s, 3H, 4'-H), 1.59 (s, 3H, 3'-CH_3), 1.05 (s, 3H, 6-CH_3) ppm. GC/MS (EI): 192 (M^+, 16), 124 (100), 109 (74), 82 (31), 69 (40), 41 (57). IR (ATR): 2965s, 2922s, 1667vs, 1449m, 1376m, 1033m cm^{-1}.

Example 2

2,4,6-Trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enone

[0026] Odor: hesperidic, fresh, floral, grapefruit, terpenic

[0027] Mixture of 2 diastereomers in a ratio of 4/1: ^{1}H-NMR (400MHz, $CDCl_3$): 6.43 (bs, 1H, 3-H), 5.09-5.03 (m, 1H, 2'-H), 2.62-2.52 (m, 1H, 4-H), 2.36-2.11 (m, 2H, 1'-H), 1.76 (s, 3H, 2-CH_3), 1.71-1.67 (m, 1H, 5_a-H), 1.68 (s, 3H, 4'-CH_3), 1.61 (s, 3H, 3'-CH_3), 1.59-1.55 (m, 1H, 5_b-H), 1.09 (d, *J* = 6.8 Hz, 3H, 4-CH_3), 1.07/1.03 (2s,3H, $6_{a,b}$-CH_3) ppm. GC/MS (EI), main isomer: 206 (M^+, 13), 164 (20), 138 (69), 123 (100), 96 (27), 69 (35), 41 (81). IR (ATR): 2962s, 2924s, 1670vs, 1453s, 1376s, 1035m, 986m cm^{-1}.

Example 3

2,3,6-Trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enone

[0028] Odor: agrestic, minty, fruity

[0029] ^{1}H-NMR (400MHz, $CDCl_3$): 5.09-5.05 (m, 1H, 2'-H), 2.33-2-29 (m, 2H, 4-H), 2.25-2.11 (m, 2H, 1'-H), 1.89 (s, 3H), 1.89-1.83 (m, 1H, 5_a-H), 1.75 (s, 3H), 1.70 (s, 3H), 1.69-1.63 (m, 1H, 5_b-H), 1.59 (s, 3H), 1.03 (s, 3H, 6-CH_3) ppm. GC/MS (EI): 206 (M^+, 9), 178 (15), 138 (100), 137 (98), 123 (97), 96 (50), 67 (52), 41 (62). IR (ATR): 2915s, 1659vs, 1638s, 1376s, 1023m, 764w cm^{-1}.

Example 4

6-Benzyl-2,6-dimethyl-cyclohex-2-enone

[0030] Odor: Fruity, minty, saffron, rosy, apple.

[0031] ^{1}H-NMR (200MHz, $CDCl_3$): 7.28-7.09 (m, 5H, Ar-H), 6.65 (bs, 1H, 3-H), 2.97 (d, *J* = 15 Hz, 1H, CH_aHPh), 2.74 (d, *J* = 15 Hz, CHH_bPh), 2.40-2.29 (m, 2H, 4-H), 1.91-1.60 (m, 2H, 5-H), 1.06 (s, 3H, 6-H) ppm. GC/MS (EI): 214 (M^+, 27), 186 (37), 123 (44), 95 (13), 91 (100), 82 (91), 77 (10), 65 (18), 54 (25), 39 (20). IR (ATR): 2923s, 1666vs, 1452s, 1375m, 1027m, 702s cm^{-1}.

Example 5

Synthesis of 1,3-dimethyl-3-(3-methyl-but-2-enyl)-bicyclo [4.1.0]heptan-2-one

[0032] Odor: rosy, vetiver, saffron, floral

[0033] Sodium hydride (60%, 2.11g, 52.8 mmol) was added to a suspension of trimethylsulfoxonium iodide (11.6g, 52.8 mmol) in 60 ml of dimethyl sulfoxide. The mixture was stirred for 30 min until hydrogen evolution stopped. 2,6-Dimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enone was added and the mixture was stirred over night at room temperature, was then diluted with water and extracted with pentane. The organic phase was washed with water and brine, dried ($MgSO_4$) and concentrated *in vacuo*. The residue was distilled (bp.95°C/0.05Torr) to yield 4.5g (83%) of product as a mixture of two diastereomers. ^{1}H-NMR (200 MHz, $CDCl_3$): 5.11-4.93 (m, 1H, 2'-H), 2.45-1.32 (m, 7H), 1.75/1.70 (2s, 3H, 4'H), 1.63/1.59 (2s, 3H, 3'-CH_3), 1.31-1.16 (m, 1H), 1.23/1.21 (2s, 3H), 1.01/0.99 (2s, 3H), 0.75-0.64 (m, 1H) ppm. GC/MS (EI): 206 (M^+, 12), 191 (14), 163 (20), 138 (90), 123 (100), 109 (34), 95 (57), 69 (62), 41 (94). IR (ATR): 2962s, 2928s, 2866s, 1681vs, 1451s, 1375m, 1043m, 1000m cm^{-1}.

Example 6

Synthesis of 2,2,6-trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-3-enone

[0034] Odor: grapefruit, sage, saffron, lavander

[0035] 2,6-Dimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enone (5.00g, 26 mmol) was added to a solution of LDA (prepared from diisopropylamine (3.15g, 31.2 mmol) and *n*-BuLi (1.6M in hexane, 19.5 ml, 31.2 mmol)) in THF (50 ml) at -78°C. Methyl iodide (5.54g, 39 mmol) was added and the solution was allowed to warm to room temperature over night. The mixture was diluted with MTBE and washed with portions of H_2O and brine, dried ($MgSO_4$) and concentrated *in vacuo* to yield 7g of a slightly yellow oil which was distilled (bp.42°C/0.005 mbar) to give 4.5 g (84%) of an olfactorily clean oil. ^{1}H-NMR (400MHz, $CDCl_3$): 5.72-5.68 (m, 1H), 5.63-5.59 (m, 1H), 5.06-4.99 (m, 1H), 2.36-2.08 (m, 4H), 1.70 (s, 3H), 1.59 (s, 3H), 1.15 (s, 3H), 1.12 (s, 3H), 1.07 (s, 3H) ppm. GC/MS (EI): 206 (M^+, 15), 191 (8), 137 (19), 123 (25), 109 (100), 96 (34), 91 (9), 81 (28), 67 (24), 41 (33). IR (ATR) : 3023s, 2966s, 2926m, 1703vs, 1456s, 1376m, 1203w, 1033s, 713s cm^{-1}.

Example 7

2,6-Dimethyl-2-(3-methyl-but-2-enyl)-cyclohexanone

[0036] Odor: grapefruit, rosy

[0037] This compound was prepared as a mixture of 2 isomers by reduction of 2,6-dimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enone with $Na_2S_2O_4$. ^{1}H-NMR (400MHz, $CDCl_3$) : 5.15-5.12, 4.94-4.89 (2m, 1H, 2'-H), 2.69-1.26 (m, 9H), 1.70, 1.68 (2s, 3H, 3'-CH_3), 1.61, 1.60 (2s, 3H, 4'-H), 1.47, 0.98 (2s, 3H, 6-CH_3), 1.00, 0.99 (2d, J = 6.8 Hz, 2-CH_3) ppm. MS (EI): 194 (M^+, 19), 179 (17), 126 (100), 111 (52), 95 (26), 69 (72), 55 (39), 41 (56). IR (ATR) : 2967m, 2929s, 2868s, 1705vs, 1452s, 1376m, 995m cm^{-1}.

Example 8

Synthesis of 1,2,6-trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol

[0038] Odor: grapefruit, cassis, borneol

[0039] 2,6-Dimethyl-6-(3-methyl-but-2-enyl)-cyclohexenone (245g, 1.28 mol) was added dropwise to a solution of methyl magnesium chloride (105g, 1.41 mol) in THF (400 ml) and toluene (1.5L) at room temperature. The temperature rose to 50°C. The mixture was stirred for additional 45 min, was then cooled to 15°C and poured on ice. The organic phase was separated and washed with water (0.5L) and brine (0.5L), dried ($MgSO_4$) and concentrated *in vacuo*. The residue was distilled over a 70 cm silverplated column (bp. 83-85°C/0.1Torr) to yield 208g (78%) product as a mixture of two diastereomers. ^{1}H-NMR (400MHz, $CDCl_3$): 5.39 (bs, 1H, 3-H), 5.29-5.24 (m, 1H, 2'-H), 2.26-2.05 (m, 2H, 2'-H), 1.98-1.88 (m, 2H, 4-H), 1.75-1.71 (m, 6H, 2-CH_3, 3'-CH_3), 1.63 (s, 3H, 4'-H), 1.60 (bs, 1H, O-H), 1.50-1.46 (m, 2H, 5-H), 1.24/1.23 (2s, 3H, $1_{a,b}$-CH_3), 0.96/0.90 (2s, 3H, $6_{a,b}$-CH_3) ppm. GC/MS (EI), Isomer **a:** 208 (M^+, 1), 190 (20), 175 (17), 147 (56), 121 (100), 105 (46), 98 (52), 83 (45), 43 (82). Isomer **b:** 208 (M+, 2), 190 (8), 175 (6), 147 (58), 121 (75), 105 (46), 98 (100), 83 (52), 43 (78). IR (ATR): 3476s, 2967vs, 2922vs, 1450s, 1376s, 1073vs, 921m, 902 m cm^{-1}.

Example 9

Synthesis of 6-methoxy-1,5,6-trimethyl-5-(3-methyl-but-2-enyl)-cyclohexene

[0040] Odor: grapefruit, agrestic, borneol, sage, lavander, lime, cassis

[0041] To a solution of 1,2,6-trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol (5.00g, 24.0 mmol) in THF (80ml) was added *n*-BuLi (1.6M in hexane, 16.5 ml, 26.4 mmol) at 0°C. After the mixture was stirred for 30 min, methyl iodide (5.18g, 36.5 mmol) was added. The mixture was stirred at room temperature over night and then poured on ice and extracted with MTBE. The organic phase was washed with H_2O and brine, dried ($MgSO_4$) and concentrated *in vacuo*. The residue was distilled (bp. 75°C/0.2 Torr) to yield 5.0g (93%) of an colorless oil containing 2 isomers: ^{1}H-NMR (400MHz, $CDCl_3$): 5.64 (bs, 1H, 2-H), 5.23-5.15 (m, 1H, CH_2CH=$C(CH_3)_2$), 3.30, 3.28 (2s, 3H, O-CH_3), 2.22-2.12 (m, 1H), 1.99-1.88 (m, 3H), 1.75-1.58 (m, 10H), 1.20,1.18 (2s, 3H), 0.93, 0.79 (2s, 3H) ppm. MS (EI): 222 (M^+, 1), 190 (11), 175 (10), 147 (60), 121 (100), 112 (30), 105 (57), 91 (40), 79 (25), 69 (14), 41 (45). IR (ATR) : 2966s, 2926s, 1449s, 1377s, 1083vs, 858m cm^{-1}.

Example 10

1,2,4,6-Tetramethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol

[0042] Odor: earthy, hesperidic, rosy, woody, grapefruit

[0043] Two diastereomers in a ratio of 5/1. Main isomer: ^{1}H-NMR (400 MHz, $CDCl_3$): 5.37-5.32 (m, 1H, 2'-H), 5.18 (bs, 1H, 3-H), 2.25 (dd, J_{gem} = 14.2 Hz, J_{vic} = 8.2 Hz, 1H, 1'-Ha), 2.20-2.10 (m, 1H, 4-H), 1.90 (dd, J_{gem} = 14.2 Hz, J_{vic} = 7.2 Hz, 1H, 1'Hb), 1.73 (s, 3H, 4'H), 1.72 (bs, 3H, 2-H), 1.64 (s, 3H, 3'-CH_3), 1.55 (ddd, J = 13.5, 6.0, 1.6 Hz, 1H, 5-Ha), 1.255 (s, 3H, 1-CH_3), 1.12 (dd, J = 13.5, 11.0 Hz, 1H, 5-Hb), 0.97 (s, 3H, 6-CH_3), 0.92 (d, J = 6.8 Hz, 3H, 4-CH_3) ppm. GC/MS (EI): 222 (M^+, 1), 207 (18), 161 (50%), 135 (90), 119 (48), 109 (66), 91 (36), 69 (36), 43 (100). IR (ATR): 3491s, 3953vs, 2917vs, 1704m, 1451vs, 1375vs, 1107vs, 1030s, 919s, 836s cm^{-1}.

Example 11

2,6-Dimethyl-6-(3-methyl-but-2-enyl)-1-vinyl-cyclohex-2-enol

[0044] Odor: borneol, grapefruit, cassis, earthy

[0045] Two isomers in a ratio of 3/2: ^{1}H-NMR (200 MHz, $CDCl_3$) : 6.02-5.82 (m, 1H, C*H*CH_2), 5.05/5.49 (2bs, 1H, 3-H), 5.31-5.15 (m, 3H, 2'-H, CHC*H*$_2$), 2.3-1.48 (m, 16H), 0.98/0.87 (2s, 3H, 6-CH_3) ppm. GC/MS (EI) isomer **a:** 220 (M+, 3), 202 (12), 133 (21), 110 (58), 95 (100), 67 (22), 55 (48), 41 (40). Isomer **b:** 220 (M+, 2), 202 (6), 133 (10), 110 (74), 95 (100), 69 (14), 55 (44), 41 (34). IR (ATR): 3511s, 2966vs, 2925vs, 1451s, 1375s, 1122m, 994s, 922s cm^{-1}.

Example 12

2,6-Dimethyl-1-ethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol

[0046] Odor: earthy, minty, floral, grapefruit

[0047] Two isomers in a ratio of 3/2: ^{1}H-NMR (200 MHz, $CDCl_3$) : 5.48 (bs, 1H, 3-H), 5.39-5.25 (m, 1H, 2'-H), 2.38-2.21 (m, 1H), 2.05-1.85 (m, 3H), 1.76-1.56 (m, 13H), 1.51-1.36 (m, 1H), 1.01-0.89 (m, 6H, CH_2CH_3, 6-CH_3) ppm. GC/MS (EI) isomer **a:** OLE_LINK12222 (M+, 2), 204 (4), 193 (79), 135 (23), 123 (30), 112 (70), 107 (43), 83 (100), 69 (59), 57 (49), 41 (50). Isomer **b:** 222 (M^+, 2), 204 (4), 193 (79), 135 (23), 123 (30), 112 (70), 107 (43), 83 (100), 69 (59), 57 (49), 41 (50). IR (ATR): 3521s, 2965vs, 2926vs, 2880s, 1452s, 1376s, 981s cm^{-1}.

Example 13

1,2,3-Trimethyl-3-(3-methyl-but-2-enyl)-bicyclo[4.1.0]heptan-2-ol

[0048] Odor: minty, rhubarb, agrestic

[0049] Mixture of two diastereomers in a ratio of 3/2: OLE_LINK3^{1}H-NMR (200 MHz, $CDCl_3$): 5.05-4.90 (m, 1H, 2'-H), 2.05-1.16 (m, 5H), 1.48/1.47 (2s, 3H, 4'-H), 1.38/1.33 (2s, 3H, 3'-CH3), 1.01-0.52 (m, 3H), 0.90/0.88 (2s, 3H), 0.77/0.75 (2s, 3H), 0.65/0.50 (2s, 3H), 0.07-(-1.85) (m, 2H) ppm. GC/MS (EI): 222 (M+, 2), 204 (4), 161 (12), 135 (28), 112 (62), 93 (60), 69 (60), 43 (100), 41 (64). IR (ATR): 3519 s, 2967vs, 2925vs, 2866vs, 1445s, 1375s, 1093m, 918m cm^{-1}.

Example 14

Synthesis of 2,6-dimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol

[0050] Odor: grapefruit, vetiver, rhubarb, rosy

[0051] 2,6-Dimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enone (5.00g, 26.04 mmol) was added dropwise to a suspension of lithium aluminium hydride (0.73 g, 18.2 mmol) in diethyl ether at 0°C. The mixture was stirred at room temperature for 1h. The resulting suspension was quenched with water, aqueous sodium hydroxide solution and again water, was then filtered and concentrated in vacuo. The residue was distilled (bp. 110°C/0.1 Torr) to yield 4.93g (98%) of the alcohol as a mixture of 2 diastereomers. ^{1}H-NMR (200MHz, $CDCl_3$): 5.49 (bs, 1H, 3-H), 5.34-5.15 (m, 1H, 2'-H), 3.57/3.44 (2d, J = 4.5, 5.5 Hz, 1H, 1-H), 2.25-1.82 (m, 4H), 1.81-1.71 (m, 6H), 1.65/1.61 (2s, 3H), 1.62-1.19 (m, 3H), 0.93/0.82 (2s, 3H, 6-CH_3) ppm. GC/MS (EI) isomer **a**: 194 (M+, 4), 176 (44), 161 (42), 125 (12), 107 (94), 84 (70), 69 (38), 55 (50), 43 (100). IR (ATR): 3365s, 2966s, 2916vs, 1450s, 1375s, 1239m, 1030m, 1007 s cm^{-1}.

Example 15

2,6-Dimethyl-6-(3-methyl-but-2-enyl)-cyclohexa-2,4-dienone

[0052] A mixture of 2,6-dimethylphenol (5.00g, 41.0 mmol), powdered KOH (85%, 1.5eq., 4.05g, 61.5 mmol), prenyl chloride (85%, 1.2eq., 6.05g, 49.2 mmol) and $(NBu_4)HSO_4$ (50mg) in benzene (50 ml) was stirred at 0°C for 3h. The green suspension was then poured on ice and extracted with pentane. The organic phase was washed with aqueous NaOH (32%), water and brine, dried ($MgSO_4$) and concentrated in vacuo at room temperature. The yellow crude dienone was ca. 85% pure and was converted without further purification. ^{1}H-NMR (400MHz, $CDCl_3$): 6.81-6.79 (m, 1H), 6.20-10 (m, 2H), 4.92-4.88 (m, 1H, 2'-H), 2.51 (dd, J = 13.9, 7.7 Hz, 1H, 1'-Ha), 2.17 (dd, J = 13.9, 7.2 Hz, 1H, 1'-Hb), 1.86 (s, 3H), 1.62 (s, 3H), 1.57 (s, 3H), 1.17 (s, 3H, 6-CH_3) ppm.

Example 16

1,2,6-Trimethyl-6-(3-methyl-but-2-enyl)-cyclohexa-2,4-dienol

[0053] Odor: grapefruit, hesperidic, floral, terpenic

[0054] ^{1}H-NMR (400MHz, $CDCl_3$): 5.69 (dd, J = 9.3, 5.2 Hz, 1H), 5.56 (dt, J = 5.2, 1.5 Hz, 1H), 5.48 (dq, J = 9.3, 0.5 Hz, 1H), 5.27-5.20 (m, 1H, 2'-H), 2.32 (dd, J = 14.0, 7.1 Hz, 1H, 1'-Ha), 2.17 (dd, J = 14.0, 8.4 Hz, 1H, 1'-Hb), 1.81, (s, 3H), 1.70 (s, 3H), 1.61 (s, 3H), 1.17 (s, 3H), 1.03 (s, 3H) ppm.

Example 17

[0055]

Green grapefruit floral composition for cosmetics	
	parts per weight
Benzyl acetate extra	35
Geranyl acetate	1
cis-3-Hexenyl acetate	6
Terpenyl acetate	3
Agrumex	35
Hexyl cinnamic aldehyde	55
Boisambrene forte (10% DPG)	2
Ethylene brassylate	20
Dimethyl benzyl carbinyl butyrate	5
Ethyl capronate (10% DPG)	7
Cetone V (10% DPG)	1
Citronellol extra	40
Cyclal C	18
Allyl Cyclohexanepropionate	5

(continued)

Green grapefruit floral composition for cosmetics	
	parts per weight
γ-Decalactone (10% DPG)	15
Dihydromyrcenol	125
Dipropylene glycol	70
β-Ionone	65
Phenoxyethyl isobutyrate	152
Lilial	80
Linalool	100
Ethyl 2-methyl butyrate	10
Allyl oenanthate	25
Orange Ess. Florida	60
Verdyl propionate	20
Hexyl salicylate	15
Terpineol	10
1,2,6-Trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol	20
	1000

[0056] In this green grapefruit accord, 1,2,6-trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol adds freshness and volume to the perfume and pushes the hesperidic orange-grapefruit aspect. Its long lasting effect helps to keep these properties over time.

Example 18

[0057]

A fougère-hesperidic perfume composition	
	parts per weight
Acetyl linalool synth.	30
Allyl amyl glycolate	5
Ambrettolide	15
Ambrofix	5
Armoise ess.	5
Bergamote ess.	80
Calone 10% DPG	25
Lemon ess. italie	30
Coumarine crist.	20
Cyclohexal	15
Dihydro myrcenol	85
Dipropylene glycol	100
Ebanol	20
Ethyl linalool	50
Evernyl	10
Fixolide	65
Florhydral	5
Geranium ess.	10
Givescone	5
Hedione	110
ISO E Super	65

(continued)

A fougère-hesperidic perfume composition	
	parts per weight
Isoraldeine 95	10
Labienoxime 10% DPG	10
Lavander ess.	15
Methyl pampelmousse	65
Radjanol	40
Sandalore	15
Clary sage ess.	5
Stemone	10
Tricyclal 10% DPG	15
Tropional	40
1,2,6-Trimethyl-6-(3-methyl-but-2-enyl)-cyclohex -2-enol	20
	1000

[0058] The grapefruit character of this fougère accord is well accentuated by 1,2,6-trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol especially in the dry down note. The compound harmonizes top and middle note and goes well together with the marine and woody facets of this perfume.

Example 19

[0059]

Blueberry flavor for a yoghurt	
	parts per weight
Geranium oil bourbon FG	0.30
Bergamot oil peel Italy	0.20
Ylang ylang oil rectified	0.05
Linalool	2.00
Orris resin (water soluble)	0.10
alpha-Terpineol	4.00
iso-Pentanol	0.70
Geraniol	0.10
Acetic acid	4.00
Acetoin (nature identical BV)	0.06
Eucalyptol	0.30
Ethyl hexanoate	1.00
Ethyl iso-pentanoat	20.00
Ethyl acetate	20.00
iso-Pentyl iso-pentanoate	12.00
Butyric acid	0.05
Ethyl butyrate	0.50
Ethyl 2-methyl butyrate	2.00
2-Methyl butyric acid	0.50
Butyl acetate	0.10
cis-3-Hexenol	0.50
iso-Pentyl acetate	3.50
Diacetyl	0.06
Methyl cinnamate	0.70
Ethyl lactate	1.00

(continued)

Blueberry flavor for a yoghurt	
	parts per weight
Tannic acid	0.05
gamma-Nonalactone	0.25
Methyl iso-pentanoate	5.00
trans-2-Hexenal	0.50
3-trans-Hexenoic acid	0.20
Propylene glycol USP	919.28
1,2,6-Trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol	1.00
	1000.00

[0060] 1,2,6-Trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol adds a natural fresh note to the flavor. The compound further boosts the blueberry-fruity taste in a yoghurt.

Example 20

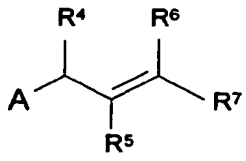
[0061]

Pink grapefruit flavor for a yoghurt	
	parts per weight
Ethanol	805.2
Nootkatone (nature identical BV)	4.8
Orange oil 7.8-fold Brazil	34.0
Juniper berry extract CO_2	10.0
Orange essence oil 10-fold Brazil	47.0
Orange oil 5-fold Palestine	50.0
Grapefruit base	48.0
1,2,6-Trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol	1.0
	1000.0

[0062] In this pink grapefruit flavor 1,2,6-trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol increases freshness and harmonizes well with its fruity-hesperidic note. The compound gives volume and a more natural taste in a yoghurt.

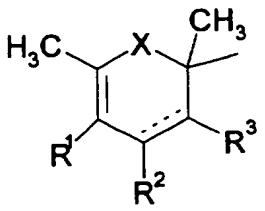
Claims

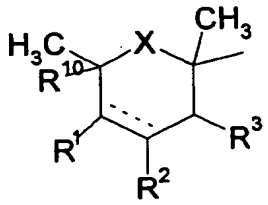
1. A compound of the formula (I)

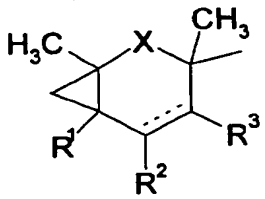


(I)

having not more than 18 carbon atoms
wherein A is a residue of the formula II, III or IV

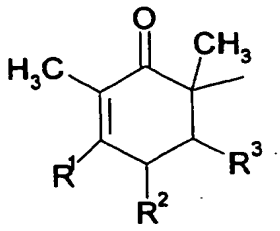

(II)


(III)


(IV)

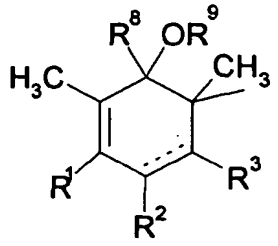
wherein
R^1-R^6 are independently hydrogen or a methyl group, R^7 is a methyl or ethyl group, and R^5 and R^7 may form together a phenyl or a furan ring;
X is either a carbonyl group or CR^8OR^9, wherein R^8 is hydrogen, methyl, ethyl, propyl, ethinyl or vinyl and R^9 is hydrogen, methyl or ethyl;
R^{10} is hydrogen, methyl or ethyl;
the dotted line in formula (II) can only be an optional double bond if X is CR^8OR^9; and
the dotted lines in formula (III) and formula (IV) are optional double bonds.

2. Compounds of formula I according to claim 1 wherein A is a residue of formula IIa


(IIa)

wherein R^1-R^3 are independently hydrogen or a methyl group.

3. Compounds of formula I according to claim 1 wherein A is a residue of formula IIb



(IIb)

wherein
R^1-R^3 are independently hydrogen or a methyl group;
R^8 is hydrogen, methyl, ethyl, propyl, ethinyl or vinyl and R^9 is hydrogen, methyl or ethyl;
and the dotted line in formula (IIb) is an optional double bond.

4. 1,2,6-Trimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol according to claim 1.

5. 2,6-Dimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol according to claim 1.

6. 2,6-Dimethyl-6-(3-methyl-but-2-enyl)-1-vinyl-cyclohex-2-enol according to claim 1.

7. 2,6-Dimethyl-1-ethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enol according to claim 1.

8. 2,6-Dimethyl-6-(3-methyl-but-2-enyl)-cyclohex-2-enone according to claim 1.

9. 6-Benzyl-2,6-dimethyl-cyclohex-2-enone according to claim 1.

10. 6-Methoxy-1,5,6-trimethyl-5-(3-methyl-but-2-enyl)-cyclohexene according to claim 1.

11. An organoleptic composition comprising a compound according to any of the preceding claims.

12. Organoleptic composition according to claim 11 comprising additional fragrance ingredients.

13. Organoleptic composition according to claim 11 comprising additional flavor ingredients.

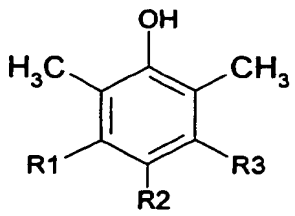
14. Consumer product comprising a compound according to claim 1.

15. Food or beverage product comprising a compound according to claim 1.

16. Use of a compound according to claim 1 as fragrance ingredient.

17. Use of a compound according to claim 1 as flavor ingredient.

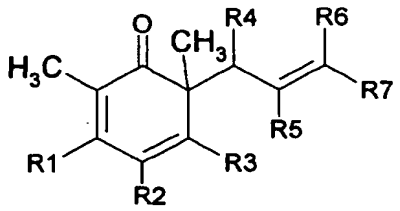
18. Method for preparing compounds of formula I according to claim 1 by reacting a phenol derivative of the formula (V)



(V)

wherein
R^1-R^3 are independently a hydrogen or a methyl group, under phase transfer conditions

to the corresponding alkylated dienone of the formula (VI)



(VI)

wherein
R^1-R^6 are H or a methyl group, R^7 is a methyl or ethyl group, and R^5 and R^7 may form together phenyl or furan ring; and selectively reducing the dienone of the formula (VI) by using a transition metal catalyst.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 12 6655

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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EUROPEAN SEARCH REPORT

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Application Number
EP 00 12 6655

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23-04-2001

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82